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WHAT IS CLAIMED IS:

1. A catoptric projection optical system for projecting a reduced size of a pattern on an object surface onto an image surface, said catoptric projection optical system comprising six mirrors that include a first convex mirror, a second mirror, a third mirror, a fourth mirror, a fifth mirror, and a sixth mirror in order of reflections of light,

wherein the light incident upon the third mirror from the second mirror intersects with the light incident upon the fifth mirror from the fourth mirror.

2. A catoptric projection system according to claim 1, said catoptric projection system forms an intermediate image between the second mirror and the third mirror on an optical path.

3. A catoptric projection optical system according to claim 1, wherein the second mirror is located at a position of an aperture stop.

4. A catoptric projection optical system according to claim 1, wherein the numerical aperture is greater than 0.2.

5. A catoptric projection optical system according to claim 1, wherein the six mirrors form a coaxial system.

6. A catoptric projection optical system according to claim 1, wherein at least one of the six mirrors are aspheric mirrors including a multilayer coating that reflect light having a wavelength of 20 nm or smaller.

7. A catoptric projection optical system according to claim 1, wherein all of the six mirrors are aspheric mirrors including a multilayer coating that reflect light having a wavelength of 20 nm or smaller.

8. A catoptric projection optical system according to claim 1, wherein the light has a wavelength of 20 nm or smaller.

9. A catoptric projection optical system according to claim 1, wherein said catoptric projection optical system is telecentric at a side of the image surface.

10. A catoptric projection optical system according to claim 1, wherein a reflection mask is arranged on the object surface.

11. A catoptric projection optical system comprising plural reflective surfaces and projecting a reduced size of a pattern on an object surface onto an image surface by reflecting light from the pattern on the plural reflective surfaces,

wherein said catoptric projection optical system has a numerical aperture of 0.2 or greater, and forms an intermediate image between the object surface and the image surface on an optical path,

wherein LMS / L12 > 1 and LW / L12 > 1 are met, where L12 is an interval between a first reflective surface, upon which the light from the pattern first is incident, and a second reflective surface as a surface, upon which the light from the pattern is incident subsequent to the first reflective surface, LMS is an interval between the object surface and a reflective surface closest to the object surface, and LW is an interval between a rear surface of a final reflective surface in said catoptric projection optical system and a reflective surface closest to the rear surface of the final reflective surface.

12. A catoptric projection optical system according to claim 11, wherein a displacement direction of a principal ray viewed from an optical axis from the first mirror to the second mirror is reverse to that from the third mirror to the sixth mirror.

13. A catoptric projection optical system according to claim 11, wherein LSM / L12 < 3 and LW / L12 < 2 are met.

14. A catoptric projection optical system according to claim 11, wherein 1.3 < LSM / L12 < 3 and 1.3 < LW / L12 < 2 are met.

15. A catoptric projection optical system according to claim 11, wherein said catoptric projection optical system includes a first convex mirror, a second mirror, a third mirror, a fourth mirror, a fifth mirror, and a sixth mirror in order of reflections of the light from the object surface to the image surface.

16. A catoptric projection optical system according to claim 11, wherein a reflective surface closest to the object surface is the second reflective surface, and a reflective surface closest to and at the

side of a rear surface of the final reflective surface is the first light.

17. A catoptric projection optical system according to claim 11, wherein said catoptric projection optical system includes six mirrors that include a first convex mirror, a second mirror, a third mirror, a fourth mirror, a fifth mirror, and a sixth mirror in order of reflections of light from the object surface to the image surface.

18. A catoptric projection optical system for projecting a reduced size of a pattern on an object surface onto an image surface, said catoptric projection optical system comprising six mirrors that include, from the object surface to the image surface, a first mirror, a second mirror, a third mirror, a fourth mirror, a fifth mirror, and a sixth mirror in order of reflections of light,

wherein the first mirror has a convex or plane shape, and

wherein an intermediate image is formed from the second mirror to the fourth mirror on an optical path.

19. A catoptric projection optical system according to claim 18, wherein an intermediate image is

formed from the third mirror to the fourth mirror on an optical path.

20. A catoptric projection optical system according to claim 18, wherein said catoptric projection optical system is non-telecentric at a side of object surface.

21. A catoptric projection optical system according to claim 18, wherein said catoptric projection optical system includes, in order from the object surface to the image surface, a second mirror, a first mirror, a fourth mirror, a sixth mirror, a third mirror, and a fifth mirror,

wherein the intermediate image is formed between the fourth mirror and the third mirror.

22. A catoptric projection optical system according to claim 21, wherein an intermediate image is formed from the second mirror to the third mirror on an optical path.

23. A catoptric projection optical system according to claim 18, wherein said catoptric projection optical system includes, in order from the object surface to the image surface, a second mirror, a first mirror, a sixth mirror, a fourth mirror, a third

mirror, and a fifth mirror, wherein the intermediate image is formed between the sixth mirror and the third mirror.

24. A catoptric projection optical system according to claim 18, wherein an intermediate image is formed from the sixth mirror to the fourth mirror.

25. A catoptric projection optical system according to claim 18, wherein said catoptric projection optical system includes, in order from the object surface to the image surface, a second mirror, a first mirror, a fourth mirror, a third mirror, a sixth mirror, and a fifth mirror, wherein the intermediate image is formed between the fourth mirror and the third mirror.

26. A catoptric projection optical system for projecting a reduced size of a pattern on an object surface onto an image surface, said catoptric projection optical system comprising six mirrors that include, from the object surface to the image surface, a first convex or plane mirror, a second mirror, a third convex or plane mirror, a fourth mirror, a fifth mirror, and a sixth mirror in order of reflections of light.

wherein an intermediate image is formed from the second mirror to the third mirror on an optical path.

27. An exposure apparatus comprising:

an illumination optical system for illuminating a pattern of a mask with light from a light source; and

a catoptric projection optical system for projecting a reduced size of the pattern on an object surface onto an image surface, said catoptric projection optical system comprising six mirrors that include a first convex mirror, a second mirror, a third mirror, a fourth mirror, a fifth mirror, and a sixth mirror in order of reflections of light, wherein the light incident upon the third mirror from the second mirror intersects with the light incident upon the fifth mirror from the fourth mirror.

28. A device fabricating method comprising the steps of:

exposing an object using an exposure apparatus; and

developing the object that has been exposed,

wherein said exposure apparatus includes:

an illumination optical system for illuminating a pattern of a mask with light from a light source; and

a catoptric projection optical system for projecting a reduced size of the pattern on the object surface onto an image surface, said catoptric projection optical system comprising six mirrors that include a first convex mirror, a second mirror, a third mirror, a fourth mirror, a fifth mirror, and a sixth mirror in order of reflections of light, wherein the light incident upon the third mirror from the second mirror intersects with the light incident upon the fifth mirror from the fourth mirror.

29. An exposure apparatus comprising:

an illumination optical system for illuminating a pattern of a mask with light from a light source; and

a catoptric projection optical system comprising plural reflective surfaces and projecting a reduced size of a pattern on an object surface onto an image surface by reflecting light from the pattern on the plural reflective surfaces, wherein said catoptric projection optical system has a numerical aperture of 0.2 or greater, and forms an intermediate image between the object surface and the image surface on an optical path, wherein LMS / L12 > 1 and LW / L12 > 1 are met,

where L12 is an interval between a first reflective surface, upon which the light from the pattern first is incident, and a second reflective surface as a surface, upon which the light from the pattern is incident subsequent to the first reflective surface, LMS is an interval between the object surface and a reflective surface closest to the object surface, and LW is an interval between a rear surface of a final reflective surface in said catoptric projection optical system and a reflective surface closest to the rear surface of the final reflective surface.

30. A device fabricating method comprising the steps of:

exposing an object using an exposure apparatus; and

developing the object that has been exposed,

wherein said exposure apparatus includes:

an illumination optical system for illuminating a pattern of a mask with light from a light source; and

a catoptric projection optical system comprising plural reflective surfaces and projecting a reduced size of a pattern on an object surface onto an image surface by reflecting light from the pattern on the plural reflective surfaces, wherein said catoptric projection optical system has a numerical aperture of

0.2 or greater, and forms an intermediate image between the object surface and the image surface on an optical path, wherein LMS / L12 > 1 and LW / L12 > 1 are met, where L12 is an interval between a first reflective surface, upon which the light from the pattern first is incident, and a second reflective surface as a surface, upon which the light from the pattern is incident subsequent to the first reflective surface, LMS is an interval between the object surface and a reflective surface closest to the object surface, and LW is an interval between a rear surface of a final reflective surface in said catoptric projection optical system and a reflective surface closest to the rear surface of the final reflective surface.

31. An exposure apparatus comprising:

an illumination optical system for illuminating a pattern of a mask with light from a light source; and

a catoptric projection optical system for projecting a reduced size of a pattern on an object surface onto an image surface, said catoptric projection optical system comprising six mirrors that include, from the object surface to the image surface, a first mirror, a second mirror, a third mirror, a fourth mirror, a fifth mirror, and a sixth mirror in order of reflections of light, wherein the first mirror

has a convex or plane shape, and wherein an intermediate image is formed from the second mirror to the fourth mirror on an optical path.

32. A device fabricating method comprising the steps of:

exposing an object using an exposure apparatus; and

developing the object that has been exposed,

wherein said exposure apparatus includes:

an illumination optical system for illuminating a pattern of a mask with light from a light source; and

a catoptric projection optical system for projecting a reduced size of a pattern on an object surface onto an image surface, said catoptric projection optical system comprising six mirrors that include, from the object surface to the image surface, a first mirror, a second mirror, a third mirror, a fourth mirror, a fifth mirror, and a sixth mirror in order of reflections of light, wherein the first mirror has a convex or plane shape, and wherein an intermediate image is formed from the second mirror to the fourth mirror on an optical path.

33. An exposure apparatus comprising:

an illumination optical system for illuminating a pattern of a mask with light from a light source; and

a catoptric projection optical system for projecting a reduced size of a pattern on an object surface onto an image surface, said catoptric projection optical system comprising six mirrors that include, from the object surface to the image surface, a first convex or plane mirror, a second mirror, a third convex or plane mirror, a fourth mirror, a fifth mirror, and a sixth mirror in order of reflections of light, wherein an intermediate image is formed from the second mirror to the third mirror on an optical path.

34. A device fabricating method comprising the steps of:

exposing an object using an exposure apparatus; and

developing the object that has been exposed,

wherein said exposure apparatus includes:

an illumination optical system for illuminating a pattern of a mask with light from a light source; and

a catoptric projection optical system for projecting a reduced size of a pattern on an object surface onto an image surface, said catoptric projection optical system comprising six mirrors that

include, from the object surface to the image surface, a first convex or plane mirror, a second mirror, a third convex or plane mirror, a fourth mirror, a fifth mirror, and a sixth mirror in order of reflections of light, wherein an intermediate image is formed from the second mirror to the third mirror on an optical path.